

Ben Moshe 3-1-1-2-1-2

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Patent Application

Applicant(s): Y. Ben Moshe et al.
Case: 3-1-1-2-1-2
Serial No.: 09/544,054
Filing Date: April 6, 2000
Group: 2189
Examiner: Christopher E. Lee

I hereby certify that this paper is being deposited on this date with the U.S. Postal Service as first class mail addressed to the Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Signature: Luisa M. Hamli Date: July 18, 2003

Title: Modular Switch With Dynamic Bus

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APPEAL BRIEF

Technology Center 2100

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Applicants hereby appeal the final rejection dated December 13, 2002 of claims 1-11, 13-29 and 31-38 of the above-identified application.

REAL PARTY IN INTEREST

The present application is currently assigned to Avaya Inc. or an associated entity. Avaya Inc. is the real party in interest.

RELATED APPEALS AND INTERFERENCES

There are no known related appeals or interferences.

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STATUS OF CLAIMS

The present application was filed on April 6, 2000 with claims 1-38. Claims 1-38 are currently pending in the application. Claims 1, 12, 13, 23, 30 and 31 are the independent claims.

Claims 1-11, 13-29 and 31-38 stand rejected. Claims 12 and 30 are allowed. Claims 1-11, 13-29 and 31-38 are appealed.

STATUS OF AMENDMENTS

Applicants submitted an Amendment After Final Rejection Under 37 C.F.R. §1.116 on March 13, 2003, amending independent claim 31 to address an objection that the Examiner had raised to claims 31, 35 and 36. The Examiner in an Advisory Action dated April 2, 2003 indicated that, for purposes of appeal, the Amendment After Final would be entered and the objection withdrawn.

SUMMARY OF INVENTION

The present invention is directed to modular switch arrangements and associated methods in which backplane sub-buses may be dynamically allocated to circuit cards. With reference to FIG. 1A of the drawings, a modular switch 20 includes a plurality of cards 24 to which computers or other devices connect. Switch 20 also includes a plurality of sub-buses 22 which are used for communication between the cards 24. As indicated in the specification at page 8, lines 1-4, each of the cards 24 has a plurality of output links 28 which connect the card to the sub-buses 22 to which it transmits, and a plurality of input links 30 with which the card listens to the sub-buses 22 it is assigned to listen to. A controller 32 receives indications regarding the current bandwidth needs of some or all of the cards 24 and accordingly allocates sub-buses 22 to the various cards 24. See the specification at page 9, lines 12-22.

It is apparent from FIG. 1A that each of the backplane sub-buses 22 comprises a physically-distinct element of a backplane bus.

The claimed arrangements provide significant improvements relative to conventional arrangements such as fixed time-domain multiplexing of sub-buses or the use of time slot allocation

in a single time-domain multiplexed bus. See the specification at, for example, page 1, lines 26-32 and page 3, lines 6-12.

ISSUES PRESENTED FOR REVIEW

1. Whether claims 1-3 are anticipated under 35 U.S.C. §102(b) by U.S. Patent No. 5,734,656 (hereinafter “Prince”).

2. Whether claims 13, 14 and 16-18 are anticipated under 35 U.S.C. §102(b) by PCT Publication WO 93/15464 (hereinafter “Porter”).

3. Whether claims 23-29 are anticipated under 35 U.S.C. §102(b) by U.S. Patent No. 5,771,358 (hereinafter “LaBerge”).

4. Whether claim 4 is unpatentable under 35 U.S.C. §103(a) over Prince.

5. Whether claim 5 is unpatentable under 35 U.S.C. §103(a) over Prince in view of U.S. Patent No. 5,838,681 (hereinafter “Bonomi”).

6. Whether claim 6 is unpatentable under 35 U.S.C. §103(a) over Prince in view of U.S. Patent No. 6,016,528 (hereinafter “Jaramillo”).

7. Whether claims 7 and 8 are unpatentable under 35 U.S.C. §103(a) over Prince in view of allegedly admitted prior art.

8. Whether claim 9 is unpatentable under 35 U.S.C. §103(a) over Prince in view of U.S. Patent Application No. 2001/0043700 A1 (hereinafter “Shima”).

9. Whether claim 10 is unpatentable under 35 U.S.C. §103(a) over Prince in view of Shima and further in view of U.S. Patent No. 6,400,819 (hereinafter “Nakano”).

10. Whether claim 11 is unpatentable under 35 U.S.C. §103(a) over Prince in view of LaBerge.

11. Whether claims 15, 31-33 and 35-37 are unpatentable under 35 U.S.C. §103(a) over Porter in view of LaBerge.

12. Whether claim 19 is unpatentable under 35 U.S.C. §103(a) over Porter.

13. Whether claims 20 and 21 are unpatentable under 35 U.S.C. §103(a) over Porter in view of U.S. Patent No. 6,219,706 (hereinafter “Fan”).

14. Whether claim 22 is unpatentable under 35 U.S.C. §103(a) over Porter in view of U.S. Patent No. 5,768,270 (hereinafter “Ha-Duong”).

15. Whether claim 34 is unpatentable under 35 U.S.C. §103(a) over Porter in view of LaBerge and further in view of allegedly admitted prior art.

16. Whether claim 38 is unpatentable under 35 U.S.C. §103(a) over Porter in view of LaBerge and further in view of U.S. Patent No. 5,875,351 (hereinafter “Riley”).

GROUPING OF CLAIMS

Certain of the above-enumerated Issues, namely, Issues 4, 5, 6, 8, 9, 10, 12, 14, 15 and 16, each involve only a single claim which stands or falls alone.

For each of the remaining Issues, the multiple claims associated with that Issue stand or fall together.

ARGUMENT

Issue 1

With regard to the rejection of claims 1-3 under 35 U.S.C. §102(b) as being anticipated by Prince, Applicants respectfully submit that Prince does not disclose each of the limitations of independent claim 1.

Independent claim 1 is directed to a modular switch. The modular switch as claimed comprises a plurality of backplane sub-buses, a plurality of cards which are each allocated one or more of the backplane sub-buses, and a controller which dynamically allocates the backplane sub-buses to the plurality of cards, based on bandwidth needs of the cards. As noted previously herein, an illustrative embodiment of the claimed arrangement is shown in FIG. 1A of the drawings, in which modular switch 20 comprises a plurality of cards 24, a plurality of sub-buses 22 and a controller 32.

The specification makes it clear that the term “sub-bus” as used therein refers to something other than a slot or set of slots of a time domain multiplexed bus. For example, the specification at page 1, lines 26-32 states as follows, with emphasis supplied:

In some switches, the bus is divided into sub-buses of the size of the maximal capacity of the cards. The sub-buses are allocated to the cards using time domain multiplexing. Such multiplexing, however, is wasteful as it gives all the cards the some [sic] amount of bandwidth regardless of their needs. In addition, this solution adds delay to packets received by a card when it is not its turn to use the bus. In some buses which use time domain multiplexing, the bus is divided into slots, and each time a transmitter needs to transmit data it requests an amount of slots. This solution, however, is too slow and complex for fast switches.

The term “sub-bus” as used in the claims is therefore clearly distinct from a slot or set of slots of a time domain multiplexed bus, in accordance with the explicit teachings of the specification. Applicants have in effect defined the term “sub-bus” in their specification to exclude a slot or set of slots of a time domain multiplexed bus.

Applicants submit that the Prince reference fails to teach or suggest a plurality of backplane sub-buses, as recited in independent claim 1. Instead, Prince relates to a switching hub in which an asynchronous transfer mode (ATM) switch is utilized as a single backplane bus. Prince states that “the present invention allows time division multiplexing of the bus under programmatic control such that each module . . . is allowed a desired number of cell slots on the bus during which to transfer data, which the module has translated into ATM cells, across the bus” (Prince, Abstract, emphasis supplied). As indicated above, this type of time domain multiplexed bus is specifically addressed, and a given slot or set of slots thereof is explicitly distinguished from the term “sub-bus,” in the specification at page 1, lines 29-32.

The Examiner in the final Office Action at page 15, section 25, argues that cell slots of a time domain multiplexed bus such as that taught by Prince meet the “plurality of backplane sub-buses” limitation of claim 1. Applicants submit that this interpretation is directly contrary to the explicit description of the term “sub-bus” provided in the above-cited portion of the specification. Given the manner in which Applicants have described the term “sub-bus” in their specification, as being distinct from a slot or set of slots of a time domain multiplexed bus, it is improper for the Examiner

to argue in a rejection of claim 1 that the claimed plurality of sub-buses are met by slots of a time domain multiplexed bus.

In summary, the present invention as recited in independent claim 1 calls for a plurality of backplane sub-buses, rather than a single time domain multiplexed bus such as that disclosed in Prince. The specification makes it abundantly clear that the term "sub-bus" as used in the present application is distinct from a slot or set of slots of a time domain multiplexed bus. Thus, it is respectfully submitted that the Prince reference does not disclose each of the limitations of independent claim 1.

Additionally, it is respectfully submitted that claims 2 and 3, which directly depend from independent claim 1, are patentable for at least the reasons that claim 1 is patentable.

Issue 2

Claims 13, 14 and 16-18 stand rejected under 35 U.S.C. §102(b) as being anticipated by Porter. However, like Prince, Porter is directed to a single physical bus. Therefore, Porter does not disclose "a plurality of backplane sub-buses" or the related limitations as recited in independent claim 13, for reasons similar to those described above with reference to independent claim 1. The arguments presented in conjunction with Issue 1 above are therefore realleged and incorporated by reference.

Additionally, it is respectfully submitted that claims 14 and 16-18, which directly or indirectly depend from independent claim 13, are patentable for at least the reasons that claim 13 is patentable.

Issue 3

Claims 23-29 stand rejected under 35 U.S.C. §102(b) as being anticipated by LaBerge. LaBerge is directed to a method which apportions bus bandwidth among bus requesters by assigning to each bus requester a bus bandwidth portion that is based on the bandwidth of the bus requester. More particularly, the LaBerge method "identifies a requester bandwidth for each of the bus requesters and sums the requester bandwidths to obtain a total bandwidth" and then "apportions the bus bandwidth among the bus requesters by assigning each bus requester a bus bandwidth portion

that reflects the weighting value of the bus requester” (LaBerge, Abstract). Again, this arrangement involves a single physical bus without separately-identifiable sub-buses, whereas the present invention, as recited in independent claim 23, is directed to an arrangement involving a plurality of sub-buses. Therefore, it is believed that LaBerge does not disclose each of the elements of independent claim 23.

It is respectfully submitted that claims 24-29, which directly depend from independent claim 23, are patentable for at least the reasons that independent claim 23 is patentable.

Issue 4

Applicants submit that dependent claim 4 is allowable for at least the reasons identified above with regard to independent claim 1. The arguments presented in conjunction with Issue 1 above are therefore realleged and incorporated by reference.

Issue 5

Applicants submit that dependent claim 5 is allowable for at least the reasons identified above with regard to independent claim 1. The arguments presented in conjunction with Issue 1 above are therefore realleged and incorporated by reference. The Bonomi reference fails to supplement the above-described fundamental deficiencies of the Prince reference.

The Federal Circuit has stated that when patentability turns on the question of obviousness, the obviousness determination “must be based on objective evidence of record” and that “this precedent has been reinforced in myriad decisions, and cannot be dispensed with.” In re Sang-Su Lee, 277 F.3d 1338, 1343 (Fed. Cir. 2002). The Federal Circuit has further stated that “conclusory statements” by an examiner fail to adequately address the factual question of motivation, which is material to patentability and cannot be resolved “on subjective belief and unknown authority.” Id. at 1343-1344.

Applicants submit that the Examiner has failed to provide any objective evidence of motivation to modify the teachings of Prince and Bonomi to meet the particular limitations of claim 5. Instead, the Examiner has provided a conclusory statement of obviousness based on the type of

“subjective belief and unknown authority” that the Federal Circuit has indicated as being insufficient to support an obviousness rejection.

Issue 6

Applicants submit that dependent claim 6 is allowable for at least the reasons identified above with regard to independent claim 1. The arguments presented in conjunction with Issue 1 above are therefore realleged and incorporated by reference. The Jaramillo reference fails to supplement the above-described fundamental deficiencies of the Prince reference. In addition, the Examiner has failed to present objective evidence of motivation to combine Prince and Jaramillo or to modify their teachings to reach the particular limitations of claim 6.

Issue 7

Applicants submit that dependent claims 7 and 8 are allowable for at least the reasons identified above with regard to independent claim 1. The arguments presented in conjunction with Issue 1 above are therefore realleged and incorporated by reference. Even if it is assumed for purposes of argument that there is admitted prior art as characterized by the Examiner, such art fails to supplement the above-described fundamental deficiencies of the Prince reference. In addition, the Examiner has failed to present objective evidence of motivation to combine Prince and the allegedly admitted prior art or to modify their teachings to reach the particular limitations of claims 7 and 8.

Issue 8

Applicants submit that dependent claim 9 is allowable for at least the reasons identified above with regard to independent claim 1. The arguments presented in conjunction with Issue 1 above are therefore realleged and incorporated by reference. The Shima reference fails to supplement the above-described fundamental deficiencies of the Prince reference. In addition, the Examiner has failed to present objective evidence of motivation to combine Prince and Shima or to modify their teachings to reach the particular limitations of claim 9.

Issue 9

Applicants submit that dependent claim 10 is allowable for at least the reasons identified above with regard to independent claim 1. The arguments presented in conjunction with Issue 1 above are therefore realleged and incorporated by reference. The Shima and Nakano references individually and collectively fail to supplement the above-described fundamental deficiencies of the Prince reference. In addition, the Examiner has failed to present objective evidence of motivation to combine Prince, Shima and Nakano, or to modify their teachings to reach the particular limitations of claim 10.

Issue 10

Applicants submit that dependent claim 11 is allowable for at least the reasons identified above with regard to independent claim 1. The arguments presented in conjunction with Issue 1 above are therefore realleged and incorporated by reference. The LaBerge reference fails to supplement the above-described fundamental deficiencies of the Prince reference. In addition, the Examiner has failed to present objective evidence of motivation to combine Prince and LaBerge or to modify their teachings to reach the particular limitations of claim 11.

Issue 11

Claims 15, 31-33 and 35-37 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Porter in view of LaBerge. As noted above, Porter is directed to a single physical bus, and therefore fails to teach or suggest a modular switch with allocation of different backplane sub-buses to different cards as claimed. The LaBerge reference fails to supplement this fundamental deficiency of the Porter reference. In addition, the Examiner has failed to present objective evidence of motivation to combine Porter and LaBerge or to modify their teachings to reach the particular limitations of claims 15, 31-33 and 35-37.

Issue 12

Applicants submit that dependent claim 19 is allowable for at least the reasons identified above with regard to independent claim 13. The arguments presented in conjunction with Issue 2 above are therefore realleged and incorporated by reference.

Issue 13

Applicants submit that dependent claims 20 and 21 are allowable for at least the reasons identified above with regard to independent claim 13. The arguments presented in conjunction with Issue 2 above are therefore realleged and incorporated by reference. The Fan reference fails to supplement the above-described fundamental deficiencies of the Porter reference. In addition, the Examiner has failed to present objective evidence of motivation to combine Porter and Fan or to modify their teachings to reach the particular limitations of claims 20 and 21.

Issue 14

Applicants submit that dependent claim 22 is allowable for at least the reasons identified above with regard to independent claim 13. The arguments presented in conjunction with Issue 2 above are therefore realleged and incorporated by reference. The Ha-Duong reference fails to supplement the above-described fundamental deficiencies of the Porter reference. In addition, the Examiner has failed to present objective evidence of motivation to combine Porter and Ha-Duong or to modify their teachings to reach the particular limitations of claim 22.

Issue 15

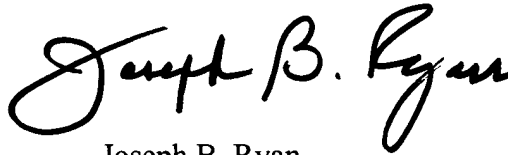
Applicants submit that dependent claim 34 is allowable for at least the reasons identified above with regard to independent claim 31. The arguments presented in conjunction with Issue 11 above are therefore realleged and incorporated by reference. Even if it is assumed for purposes of argument that there is admitted prior art as characterized by the Examiner, such art fails to supplement the above-described fundamental deficiencies of the Porter reference. In addition, the Examiner has failed to present objective evidence of motivation to combine Porter and the allegedly admitted prior art or to modify their teachings to reach the particular limitations of claim 34.

Issue 16

Applicants submit that dependent claim 38 is allowable for at least the reasons identified above with regard to independent claim 31. The arguments presented in conjunction with Issue 11 above are therefore realleged and incorporated by reference. The LaBerge and Riley references individually and collectively fail to supplement the above-described fundamental deficiencies of the Porter reference. In addition, the Examiner has failed to present objective evidence of motivation to combine Porter, LaBerge and Riley, or to modify their teachings to reach the particular limitations of claim 38.

In view of the foregoing, Applicants believe that claims 1-11, 13-29 and 31-38 are in condition for allowance, and respectfully request the withdrawal of the §102(b) and §103(a) rejections.

Respectfully submitted,

A handwritten signature in black ink that reads "Joseph B. Ryan". The signature is written in a cursive, flowing style with a large, prominent "J" and "R".

Date: July 18, 2003

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APPENDIX

1. (Amended) A modular switch, comprising:
a plurality of backplane sub-buses;
a plurality of cards which are each allocated one or more of the backplane sub-buses; and
a controller which dynamically allocates the backplane sub-buses to the plurality of cards,
based on bandwidth needs of the cards.
2. (Amended) The switch according to claim 1, wherein a bandwidth capacity of substantially all the backplane sub-buses is less than the sum of a maximal transmission bandwidth capacity of the cards.
3. (Amended) The switch according to claim 1, wherein the controller is implemented by one of the cards.
4. (Amended) The switch according to claim 3, wherein the controller is implemented by one of the cards which is selected dynamically.
5. (Amended) The switch according to claim 1, wherein the cards transmit messages which indicate their bandwidth needs to the controller.

6. (Amended) The switch according to claim 1, wherein each of the cards has a priority value which indicates its entitlement to bandwidth and the controller allocates the backplane sub-buses based on the priority values of the cards.
7. (Amended) The switch according to claim 1, wherein substantially all the backplane sub-buses have the same bandwidth capacity.
8. (Amended) The switch according to claim 1, wherein the plurality of backplane sub-buses comprise at least two sub-buses with different bandwidths.
9. (Amended) The switch according to claim 1, wherein the controller confiscates one or more sub-buses from one or more of the cards when the one or more sub-buses are more needed by one or more other cards.
10. (Amended) The switch according to claim 9, wherein the controller does not allocate a confiscated sub-bus to a card before it receives confirmation from the card from which the sub-bus was confiscated that the sub-bus was freed from its allocation.
11. (Amended) The switch according to claim 1, wherein the controller calculates, for each of the cards, a bus demand value which represents an entitlement and need of the card to receive a sub-bus, and the controller allocates free sub-buses which are not allocated to the cards with the highest bus demand values.

12. (Amended) A modular switch comprising:

a plurality of backplane sub-buses;

a plurality of cards which are each allocated one or more of the backplane sub-buses; and

a controller which dynamically allocates the backplane sub-buses to the plurality of cards, based on bandwidth needs of the cards;

wherein the controller calculates, for each of the cards, a bus demand value which represents an entitlement and need of the card to receive a sub-bus, and the controller allocates free sub-buses which are not allocated to the cards with the highest bus demand values; and

further wherein the controller confiscates sub-buses from cards whose bus demand value without the confiscated sub-buses is lower than the bus demand value of a different card after the confiscated sub-buses are transferred to it.

13. A modular switch, comprising:

a plurality of backplane sub-buses; and

a plurality of cards which are configurable to listen to a variable number of the backplane sub-buses.

14. (Amended) The switch according to claim 13, wherein at least one of the plurality of cards listens to fewer than all the backplane sub-buses.

15. (Amended) The switch according to claim 13, comprising a controller which dynamically changes the sub-buses to which each card listens.

16. (Amended) The switch according to claim 13, wherein each of the cards is configured to listen to a respective group of peer cards.
17. (Amended) The switch according to claim 16, wherein the sub-buses to which each of the plurality of cards listens are the sub-buses to which the respective group of peer cards transmit.
18. (Amended) The switch according to claim 16, wherein each card listens to the cards which listen to it.
19. (Amended) The switch according to claim 16, wherein at least one card listens to fewer than all the cards that listen to it.
20. (Amended) The switch according to claim 16, wherein the peer group of one or more cards changes as a function of time.
21. (Amended) The switch according to claim 20, wherein the peer groups are reduced in size during high security times.
22. (Amended) The switch according to claim 13, comprising for at least one of the cards a filter which passes to the card only data from the sub-buses to which the card listens.
23. (Amended) A method of allocating sub-buses to cards of a switch, comprising:

determining bandwidth needs of each of the cards;

assigning each of the cards a bus demand value which is a function of the bandwidth needs of the card and the current bandwidth allocated to the card; and

allocating the sub-buses to the cards based on the bus demand values of the cards.

24. (Amended) The method according to claim 23, wherein determining the bandwidth needs of the cards comprises receiving messages from the cards.

25. (Amended) The method according to claim 23, wherein determining the bandwidth needs of a card comprises determining a measure of utilization of the sub-buses currently allocated to the card.

26. (Amended) The method according to claim 23, wherein determining the bandwidth needs of a card comprises listening to the sub-buses currently allocated to the card.

27. (Amended) The method according to claim 23, wherein assigning each of the cards a bus demand value comprises assigning a bus demand value which is a function of a priority of the card.

28. (Amended) The method according to claim 23, wherein assigning each of the cards a bus demand value comprises assigning a bus demand value which is a function of a minimal number of sub-buses which must be allocated to the card.

29. (Amended) The method according to claim 23, wherein allocating the sub-buses to the cards comprises allocating sub-buses not currently allocated to a specific card as additional sub-buses to the cards with the highest bus demand values.

30. (Amended) A method of allocating sub-buses to cards of a switch, the method comprising the steps of:

determining bandwidth needs of each of the cards;

assigning each of the cards a bus demand value which is a function of the bandwidth needs of the card and the current bandwidth allocated to the card; and

allocating the sub-buses to the cards based on the bus demand values of the cards;

wherein allocating the sub-buses to the cards comprises confiscating sub-buses from cards which have lower bus demand values without the confiscated sub-buses than the bus demand values of other cards with the confiscated sub-buses.

31. (Twice Amended) A modular switch, comprising:

a plurality of communication cards;

a plurality of backplane sub-buses each allocatable to one or more of the cards; and

at least one controller which is configurable to divide the cards into different numbers of groups, such that the cards of the different groups do not transmit data to each other, wherein the at least one controller is further configurable to allocate the sub-buses to the cards based on bus demand values of the cards.

32. (Amended) The switch according to claim 31, wherein the at least one controller is configurable to divide the cards into any number of groups between one and the number of cards.

33. (Amended) The switch according to claim 31, wherein the at least one controller divides the cards into a number of groups configured by a user.

34. (Amended) The switch according to claim 31, wherein the at least one controller divides the cards into a number of groups equal to a number of types of cards included in the plurality of cards.

35. (Amended) The switch according to claim 31, wherein the cards of the different groups do not communicate with each other.

36. (Amended) The switch according to claim 31, wherein the cards of the different groups do not communicate over any of the plurality of backplane sub-buses.

37. (Amended) The switch according to claim 31, comprising a box having a plurality of slots in which the cards are located and wherein the cards of at least one group are not located in adjacent slots.

38. (Amended) The switch according to claim 31, wherein only one card writes to a sub-bus at any single time.